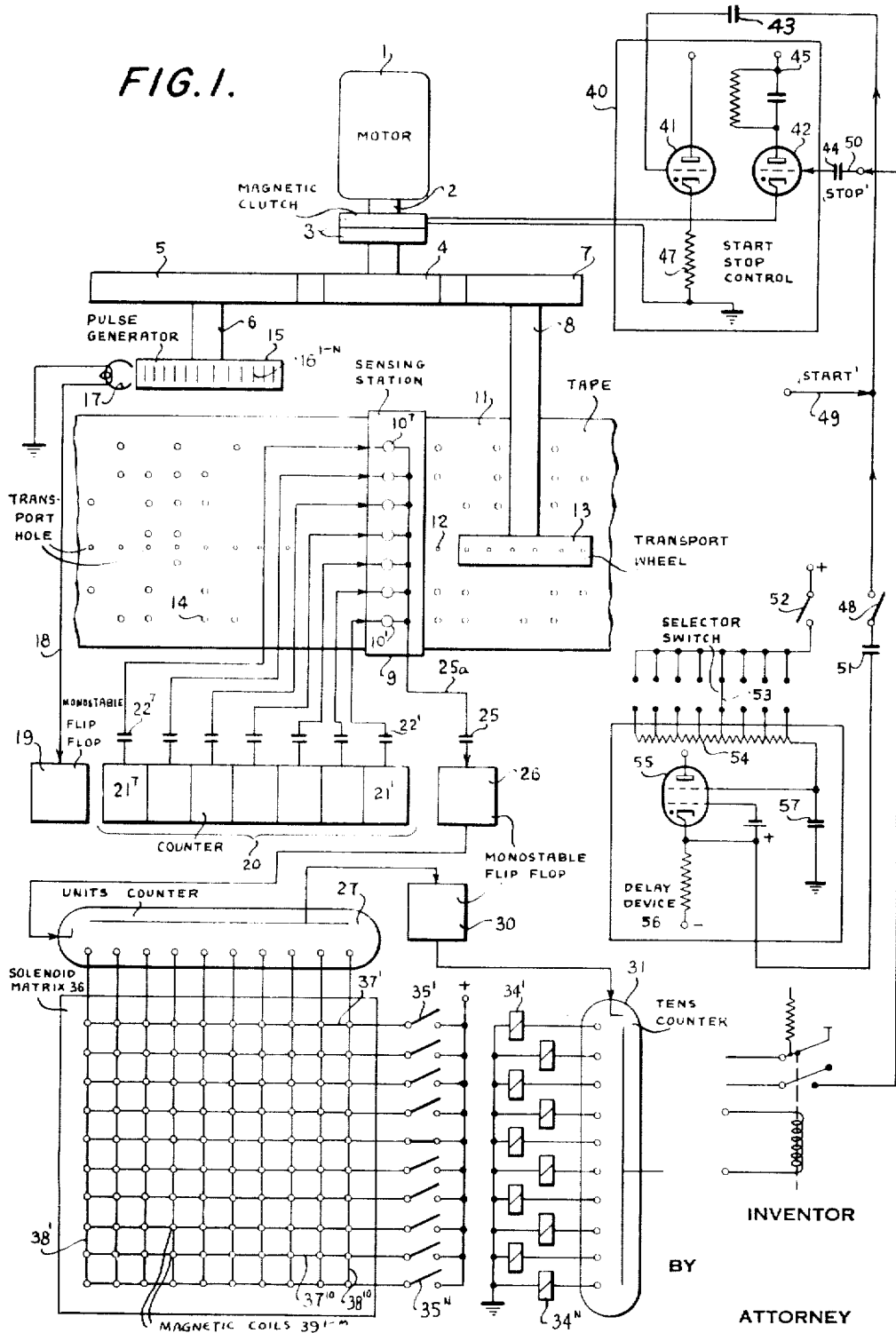


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FIG. 2.

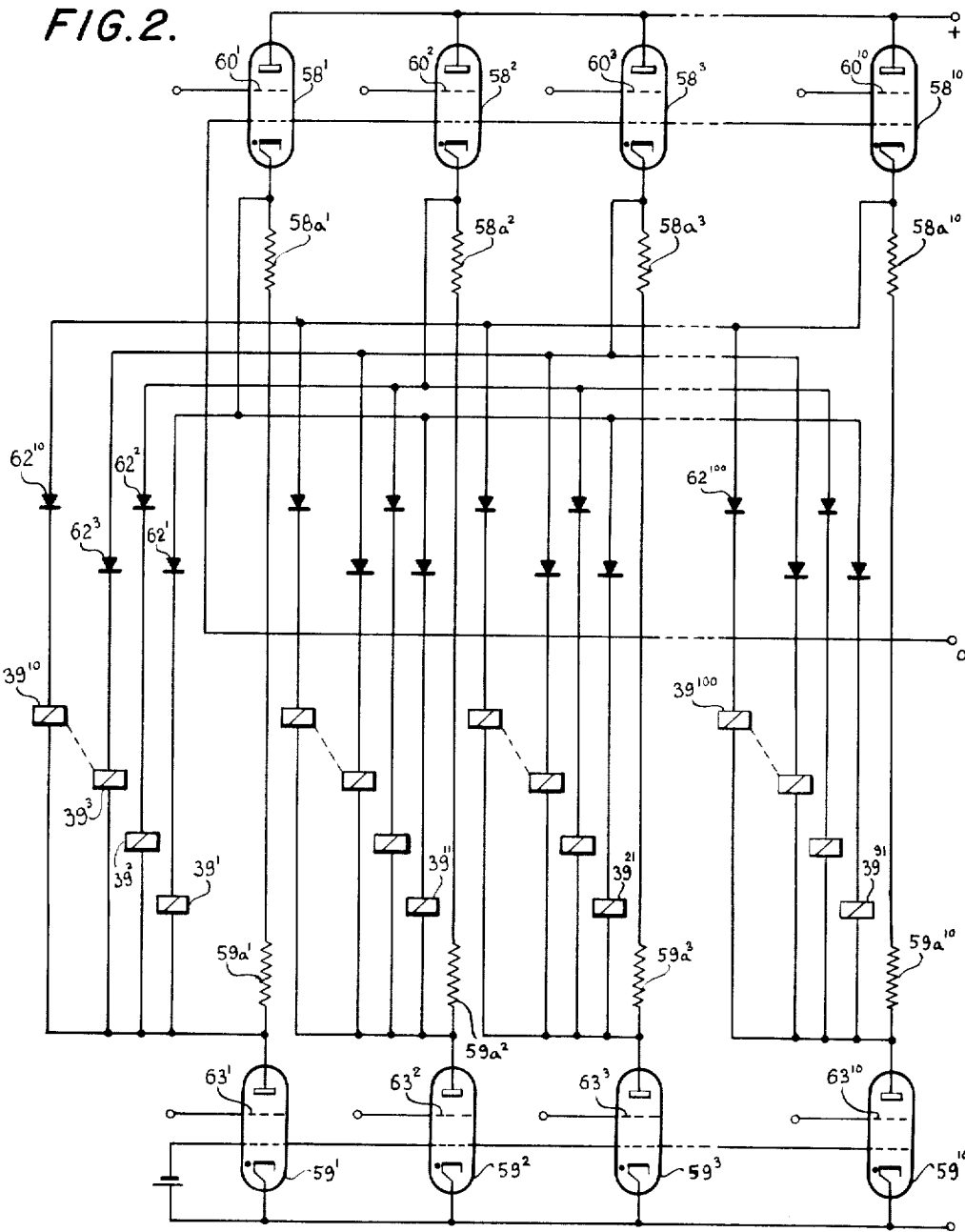


FIG. 4.

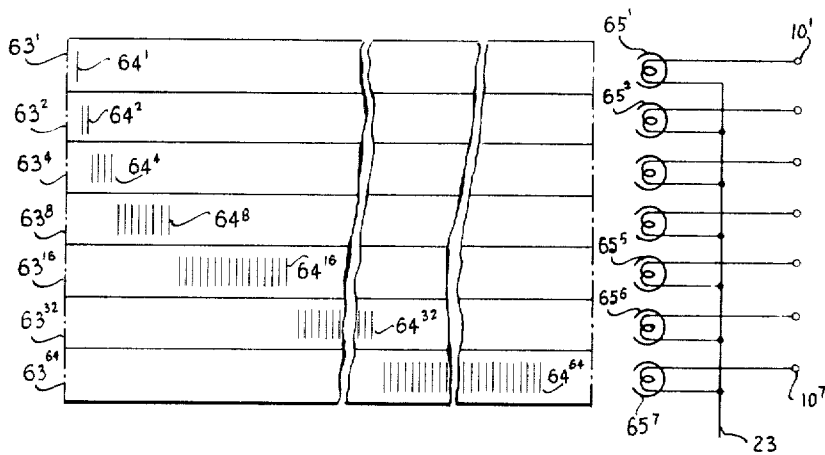
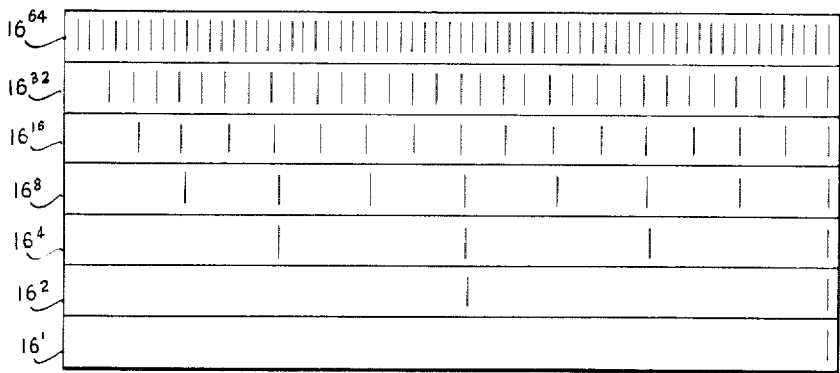


FIG. 3.



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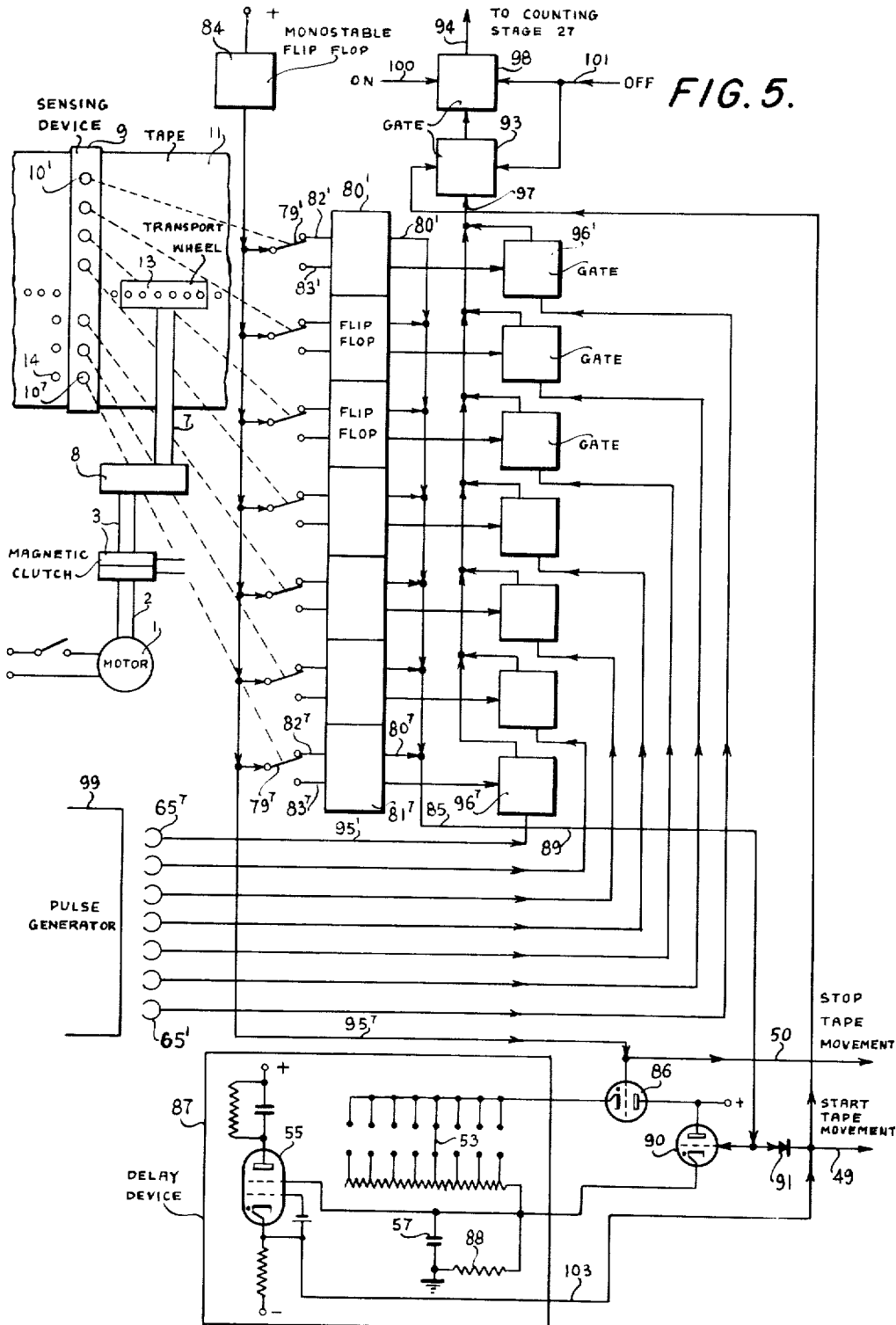
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SIGNAL OPERATED CONTROL MEANS FOR KEYBOARD AND LIKE MACHINES

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SIGNAL OPERATED CONTROL MEANS FOR KEYBOARD AND LIKE MACHINES

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25,885/56

12 Claims. (Cl. 340—172.5)

The present invention relates to a control means for the actuation of selectively-operable machines such as keyboard and the like machines. A control means of this type would be operative between an input means for signals, such as a punched tape, punched cards, magnetic tape or other magnetic records, and a selectively-operable assembly such as might normally be operated from a keyboard, the components of which assembly are to be selected and operated in dependence on the signals sensed at said input means.

An important use of the invention is in the operation of a line-composing machine, for example, from a punched tape.

It is one object of the invention to provide an improved form of controllable delay means for effecting or not effecting, as desired, a delay between two successive sensings of input signals. In a line-composing machine, for example, as is well known, a delay might be required for any of the following reasons, among others:

- (a) The machine requires a longer time to operate when succeeding signal combinations are identical than when they are not identical;
- (b) If a line has to be justified, time is required for this before the setting of the next line begins;
- (c) In cases where there are several magazines, having different type faces, time is required to make a selection when another type face is to be used; and
- (d) Time is required, in differing amounts, to operate the elevator at the ending of a line and to prepare the machine for a new line.

It is therefore an object of the invention to provide an electrical means for effecting this delay.

It is a further object of the invention to provide in some cases an electrical means whereby the length of the delay is preselected and operates without reference to the state of the machine at the time.

It is a still further object of the invention to provide in other cases an electrical means whereby the length of the delay is dependent on the time taken by the machine to complete the function then in progress.

It is another object of the invention to provide an improved means for selecting from an assembly of operating elements, the particular element to be operative at the time, by having these elements disposed in a crosswise arrangement and by making the selection from two directions in dependence on two components or symbols by which that particular element is represented.

The preceding object may be further developed in that each such element is represented by a number of two or more denominations, and in that a selection in one direction is dependent on one or some of those denominations while the selection in the other direction is dependent on the remaining denomination or denominations.

In accordance with one feature of the present invention, windings or magnet coils in a crosswise arrangement, for example, of vertical and horizontal rows, or of radial and circumferential rows, are selected by counting a predetermined value of signals corresponding to the selection, the count being in at least two denominations, one or some of which selects the row in one direction (e.g.,

vertical) and the other of which selects the row in the other direction (e.g., horizontal). The counting may be accomplished by a pair of counting tubes or of counting chains, one for each of two denominations, one for each said direction, with a carry-over from one tube or chain to the other.

With combination signals each combination is regarded as a binary number, and for each signal in a combination which is sensed a corresponding value is counted, the respective values being totalized in the counter to provide a decimal number representative of the combination.

In accordance with another feature of the present invention, the said counting and the energizing of the correspondingly selected windings are carried out in successive sensing periods and a comparing means is provided whereby the sensing of the same combination in two succeeding rows gives rise to a delay period between the successive energizing of the windings, whereas the sensing of two succeeding combinations which differ gives rise to no delay.

In order that the present invention may be readily carried into effect, it will now be described with reference to the accompanying drawings, wherein:

FIG. 1 is a schematic diagram of an embodiment of a control circuit between a punched tape sensing means and a contact assembly having its contacts in a crosswise arrangement of horizontal and vertical rows, these contacts controlling the means (not shown) which are to be selectively operated;

FIG. 2 is a schematic diagram of an embodiment of a selection circuit utilizing discharge tubes for the selection of contacts in the embodiment of FIG. 1;

FIG. 3 is a timing diagram illustrating the sequence of sensed signals in the embodiment of FIG. 1;

FIG. 4 is a diagram illustrating an alternative arrangement of stored counting signals for use as hereinafter described; and

FIG. 5 is a schematic diagram of a modification of the control circuit of FIG. 1, in which a comparison and delay circuit are utilized.

FIG. 1 illustrates the sensing of a punched tape for operation of an assembly of one hundred contacts. The assembly may be in an adaptor placed over the keyboard of, for example, a line-composing machine to operate corresponding keys, or placed under the keyboard for a similar purpose, or it may replace a normal keyboard.

The apparatus comprises a motor 1 driving a shaft 2, which shaft is coupled with a gear 4 through a magnetic clutch 3 which is controlled by the electronic discharge arrangement 40 as hereinafter described. The gear 4 effects a stepwise drive operating the gear 5 on axis 6 and the gear 7 on the axis of a shaft 8.

The sensing station 9 with sensing means 10¹⁻⁷ (for example, in the form of pins or sensing brushes) is arranged above the tape 11. The tape 11 is provided with signals in transverse rows and has seven longitudinal code channels for combination signals in a seven code combination in said transverse rows. The tape 11 has transport holes 12 in which the transport wheel 13, driven by gear 7, engages, to advance said tape stepwisely. In the code channels are perforated holes 14, within the respective transverse rows, and the possible number of code combinations is sufficient at least for 100 keys from which the selections are to be made.

A wheel 15 has pulse generating means 16¹⁻ⁿ arranged around its circumference. The circumference of the wheel 15 may be of non-magnetic material into which slots are cut to receive and hold small permanent magnets arranged around the circumference, so that these magnets may be sensed successively by a sensing head

17 during the relative movement between said circumference and said sensing head.

The signals sensed by head 17 generate pulses on the lead 18 which are fed to monostable flip-flop 19. This, in consequence delivers pulses to the seven stage counting chain 20 having stages 21¹⁻⁷. The chain 20 may be a flip-flop chain of known type. It may, however, be of other types, such as, for example, cold cathode tubes, or magnetic core chains, or of similar type. To each such stages 21¹⁻⁷ is connected the respective sensing means 10¹⁻⁷ of the different code channels, the connection being through leads which include capacitors 22¹⁻⁷.

Pulses delivered from the monostable flip-flop 19 enter the counting chain at the lowest stage 21⁷. Within the same time period in which the flip-flop of counting stage 21⁷ is switched over 64 times, stage 21⁶ will be switched over 32 times, stage 21⁵ will be switched over 16 times and so on. Finally, stage 21¹ will have only one change-over during such time period.

The function of the counter 20 is to generate trains of pulses for application to the sensing elements 10¹⁻⁷ in such a way that a number of pulses appear on line 25a equal to the binary value of the particular code combination which is being sensed by the sensing elements. The ratio of the gearing between the shafts 6 and 8 and the positioning of the pulse generator elements 16¹⁻ⁿ is such that one hundred and twenty-eight pulses occur in lead 18 during the time when one transverse row of perforations in the tape 11 is beneath the sensing elements 10¹⁻⁷. The monostable flip-flop 19 merely reshapes these pulses for application to the counter 20. The capacity of the counter 20 is one hundred and twenty-eight, since it has seven binary stages in cascade. The counter therefore goes through one complete cycle of operation for each code combination which is sensed by the sensing elements 10¹⁻⁷.

The stage 21⁷ of the counter 20 will be switched on sixty-four times during the cycle of operation and will produce a corresponding number of output pulses which are fed via capacitor 22⁷ to sensing element 10⁷. If there is a perforation in the position sensed by the sensing element 10⁷, this element completes a circuit to the line 25a. This allows the sixty-four pulses produced by the counter stage 21⁷ to be fed via the sensing element 10⁷, line 25a and capacitor 25 to the input of monostable flip-flop 26. Conversely, if there is no perforation in this position, the tape 11 insulates the sensing element 10⁷ from the line 25a and no pulses pass from the counter stage 21⁷ to the flip-flop 26.

The stage 21⁶ applies thirty-two pulses to sensing element 10⁶, the stage 21⁵ applies sixteen pulses to sensing element 10⁵, and so on. These pulses are passed or not to the line 25a in accordance with whether or not a perforation is being sensed by the corresponding sensing element. In this way, the line 25a receives, during the sensing of one code combination from the tape, a number of pulses equal to the value of that code combination, where the positions sensed by the elements 10¹, 10², 10³, etc., are given the values 1, 2, 4, etc.

The inherent switching time of the stages of the counter 20 causes the output pulses from the different stages to be relatively staggered in time (see FIG. 3). Thus, although a single pulse from the flip-flop 19 may produce output pulses from several stages of the counter 20, such output pulses are not simultaneous and may be combined on the line 25a without mutual interaction.

The monostable flip-flop 26 operates the gas discharge tube counting device 27 (which may be a Dekatron) in such a way that each input pulse will move the glow discharge from one stage to the next. If for instance there is a hole in the lower (first) code channel and in the third code channel, the counting tube 27 would receive within the time of the sensing cycle for one transverse row, five pulses, that is, the sum of 1 plus 4 pulses. The counting tube 27 is operated in a known way so that a

switching over from one cathode to the next takes place if a pulse is received from the monostable flip-flop 26. The glow discharge between the anode and one of the cathodes therefore switches from cathode to cathode in dependence on the delivery of the pulses.

From the last stage of the counting tube 27 there is a connection to the carry-over monostable flip-flop 30 connecting the counter 27 with another counter 31. It is evident that instead of Dekatron tubes other counters may be employed, such as discharge tubes of certain types connected in an arrangement such as is shown in more detail in FIG. 2.

The carry-over device 30 receives a pulse at each tenth pulse delivered to counting tube 27, as only the last stage of tube 27 is connected with said carry-over device. The carry pulses operate the counting arrangement 31, which comprises a further multi-cathode gas discharge counting tube. The circuit of each cathode of counter 31 includes one of the relay coils 34¹⁻ⁿ operating the respective relay contacts or switches 35¹⁻ⁿ in such a way that each contact is closed when the corresponding cathode of the counter is conductive, all other cathodes then being non-conductive and all other contacts 35 being open.

The switches 35¹⁻ⁿ may complete switching circuits through the horizontal rows 37¹⁻¹⁰ of the key magnet coils or winding 39^{1-m} in the solenoid matrix or keyboard assembly 36 which, as hereinbefore explained, may be a keyboard, keyboard adaptor or otherwise. In the horizontal rows 37¹⁻¹⁰ there are arranged windings in such a way that each magnet has one winding 39^{1-m} connected through the respective switch 35¹⁻ⁿ to the common positive polarity terminal, and another winding controlled from counting tube 27, the ten stages of which have respective outputs leading in parallel to the vertical rows 38¹⁻¹⁰. The double windings provide a crosswise control of the keyboard magnets. Each of the magnets is operable by the closing of a switch 35 in the respective horizontal row and the ignition of a discharge stage of counting tube 27 in a vertical row. Therefore, only one of the magnet coils 39^{1-m} will be energized at any one time, in dependence on the coincident excitation of the two counting arrangements 27 and 31. In FIG. 1, the switch 35⁵ is shown in the closed position. The connections may be made through amplifier triodes or the like, in dependence on which type of counting tubes 27 and 31 are used. The tubes 27 and 31 therefore represent a two-denomination number of which the "units" symbolize a vertical input into the assembly and the "tens" symbolize a horizontal input into the assembly.

The magnetic clutch 3 is under the control of the start and stop arrangement indicated generally at 40 (FIG. 1). This start and stop arrangement comprises the discharge tubes 41 and 42. Discharge tube 41 is ignited by a start signal delivered to its grid through capacitor 43, from, for example, the input lead 49 marked "Start" in FIG. 1 or through the switch 48 in the closed position. The discharge tube 42 is ignited by a stop signal delivered to its grid through capacitor 44 from the input lead 50 marked "Stop" in FIG. 1. In the circuit of discharge tube 41 is the cathode resistor 47 connected with the magnet coil within the magnetic clutch arrangement 3, so that this clutch is operative to engage the drive when energized by the igniting of discharge tube 41 under the control of a start signal.

The stepwise drive or transport wheel 13 will move tape 11 stepwisely below the sensing means 10¹⁻⁷ until in any particular transverse row signals are sensed for effecting a stoppage of said tape. This stoppage is brought about because within the coil arrangement 39^{1-m} of the keyboard assembly 36 there is arranged a relay coil instead of a direct control coil for a key magnet, whereby the corresponding key is not directly energized but, first, there is energized the said relay which has a contact to energize said key magnet coil, to operate that key, and which also has a contact delivering current to the input lead 50.

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This effects the delivery of a pulse through capacitor 44 to discharge 42, which ignites discharge tube 42 with the consequent extinguishing of discharge tube 41 because positive polarity terminal 46 has a higher potential than the anode of discharge tube 41. Discharge tube 42 will extinguish itself after discharging capacitor 45.

Such a stop signal is delivered from the keyboard for all those pulse combinations in which the usual stepwise tape transport from one transverse row to the next is to be interrupted to provide a necessary delay before the actuation of the next key. Some of these key operations will release certain functions which require a delay of for instance one, two, five, ten or up to twenty normal stepping times of the tape feed. These delays are under the control of a delay arrangement shown generally at 56 and comprising capacitor 57, discharge tube 55, and the resistor 54 which has a plurality of tapping points. The relay device 56 is used in all those cases in which there is to be an automatic switching in of the stepwise feed after a predetermined delay period.

If there is a device which has no automatic switching in after predetermined delay periods, but in which another switch is to be operative, such switch will deliver a pulse after the intervening operation has taken place, the pulse going to capacitor 43 at the "start" input lead 49. Thereupon, the tape feed and the sensing of the combination signals recommences and continues as hereinbefore described.

The start pulse could, for example, be delivered by the operation of the elevator of a line-composing machine. The movement of the elevator may be started by the closing of a contact at the respective selected relay coil in the field of magnetic coils 39^{1-m}, operating the respective key of the keyboard, and the tape feed be stopped at the same time by the delivering of a pulse from this relay contact to the "stop" lead 50. Upon the arrival of the said elevator at its upper position, a signal is delivered to the "start" lead 49 and the mechanism starts anew.

But at other parts of such a machine there may be time periods required for other operations. These are effected by closing contact 52 which makes connection with one or other of the tapping points of resistor 54 by selector switch 53. Therefore, the current from the positive polarity terminal passes through closed switch 52 and the respective tapping point of the resistor 54 to the capacitor 57, which is charged at a rate depending upon the position of switch 53, to measure a time period sufficient to ignite discharge tube 55 at the desired instant. The tube 55 is prebiased to a predetermined extent so that capacitor 51 receives a pulse when the voltage on capacitor 57 has risen sufficiently to ignite tube 55. The pulse reaching capacitor 51 may be led through the closed contact 48 to the capacitor 43 to ignite discharge tube 41 thereby to start the tape feed and the sensing anew. Switch 48 must remain closed in order to provide a continuous-operating device.

FIG. 2 illustrates the selecting device for the different relay coils in the crosswise arrangement 39^{1-m}. Two sets of discharge tubes 58¹⁻¹⁰ and 59¹⁻¹⁰ are used. These may be either discharge tubes connected in a counting chain according to the counting stages of the arrangements 27 and 31, or they may be controlled by said counting stages respectively. The ignition of discharge tubes 58¹⁻¹⁰ takes place by a pulse to control grids 60¹⁻¹⁰ of said last-mentioned tubes whereas the ignition of any one of the discharge tubes 59¹⁻¹⁰ takes place by delivering a pulse to the control grids 63¹⁻¹⁰ of said last-mentioned tubes. These sets of discharge tubes are negatively prebiased by a second control grid. The upper set of discharge tubes 58¹⁻¹⁰ is arranged between a plus potential of for instance 250 volts and zero potential 0, while the lower set of discharge tubes 59¹⁻¹⁰ is arranged between zero potential 0 and a negative potential of for instance -250 volts. In the cathode circuit of each of the discharge

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tubes 58¹⁻¹⁰ is a cathode resistor 58a which has a relatively high value. These are shown at 58a¹⁻¹⁰ and are used to complete a discharge circuit for the respective tubes 58¹⁻¹⁰. Likewise there is in the anode circuit of each of the discharge tubes 59¹⁻¹⁰ the relatively high value resistor 59a¹⁻¹⁰ completing the discharge circuits for these tubes.

Between the two rows of discharge tubes there are connected the coils 39^{1-m} forming, according to FIG. 1, coils actuating the respective keys of the keyboard adaptor or the like 36 and also relay coils operating such keys indirectly to control delay arrangements as hereinbefore explained. Furthermore, there are interconnections between the first row of discharge tubes 58¹⁻¹⁰ and the second row of tubes 59¹⁻¹⁰ which lead respectively each through one of said windings of said coils 39^{1-m} and there is a diode 62^{1-m} interconnected in each of the said connections between one discharge tube in the row 58¹⁻¹⁰ and one of the discharge tubes in the row 59¹⁻¹⁰.

The discharge tubes 58¹⁻¹⁰ may make the vertical selection according to the vertical rows in the arrangement in FIG. 1, whereas the tubes 59¹⁻¹⁰ may make the horizontal selection according to said arrangement. There is only one switching circuit between any one of the discharge tubes 58¹⁻¹⁰ and any one of discharge tubes 59¹⁻¹⁰, this going through a corresponding one of the one hundred coils 39^{1-m}. There is, for instance, upon ignition of discharge tube 58¹ and tube 59¹, a switching circuit from the positive polarity terminal through the anode of discharge tube 58¹ to its cathode and from there through the diode 62¹ to the winding 39¹ to the anode of discharge tube 59¹, and from there through the cathode to the negative polarity terminal. If only the tubes 58¹ and 59¹ are ignited, only the coil 39¹ is energized.

If, instead of discharge tubes 58¹ and 59¹, the discharge tube 58² and the discharge tube 59¹ are ignited, the connection would be from the positive polarity terminal through discharge tube 58², through diode 62² to coil 39² and then to the anode of discharge tube 59¹, and from its cathode to the negative polarity terminal. If, instead, discharge tube 58³ and discharge tube 59¹ are ignited there would be a current from the positive polarity terminal through the ignited discharge tube 58³, through diode 62³ and coil 39³ to the anode of discharge tube 59¹ and from its cathode to the negative polarity terminal. It is evident, therefore, that by selecting only two of the said ten discharge tubes, one in each set, any one coil of the said one hundred coils 39^{1-m} may be selected for excitation to operate the corresponding key or to effect whatever other one hundred functions are represented by the assembly 39^{1-m}. If the rows of discharge tubes 58¹⁻¹⁰ and 59¹⁻¹⁰ are to be controlled by counting tubes having only low currents in their different stages, for example if they are of the cold cathode type, then the switches are prepared to allow an ignition of only one of the tubes 58¹⁻¹⁰ and 59¹⁻¹⁰, respectively, if the said counting tubes have already taken their respective anode positions for the sensed transverse row in dependence on the respective holes in the different code channels of the tape.

FIG. 4 shows another arrangement for delivering pulses under control of the sensing elements 10¹⁻⁷, the pulses for the several channels in this case being generated in series. This arrangement may also be used for the delivery of pulses in a device according to FIG. 5.

The generation of these pulse sequences is illustrated in FIG. 4 under the control of rotary record element 99 (shown in FIG. 4 as a development) having one signal 64¹ in the track 63¹, two signals 64² in the track 63², four signals 64⁴ in the track 63⁴, eight signals 64⁸ in track 63⁸, sixteen signals 64¹⁶ in track 63¹⁶, thirty two signals 64³² in track 63³² and sixty four signals in track 63⁶⁴. However, the signals in each track are arranged between those in the preceding and in the succeeding track so that, in a complete sensing of the record during one

rotation, first the sixty four signals 64^{64} are sensed by sensing head 65^7 and immediately afterwards the sensing by sensing head 65^6 of the thirty two signals 64^{32} in track 63^{32} begins, and so on, so that after the sensing of the two signals 64^2 by sensing head 65^2 the last signal to be sensed is the one signal 64^1 in track 63^1 , sensed by sensing head 65^1 .

Referring now to FIG. 5, an arrangement is shown in which a pulse generator according to FIG. 4 is used. This arrangement includes the motor 1 which operates the stepwise drive gear 8 from shaft 2 through magnetic clutch 3. Further, there is a sensing device 9 with sensing elements 10^{1-7} for sensing the holes 14 punched in tape 11. The transport wheel or driving device 13 for this tape 11 is operated from said stepwise drive 8 through shaft 7. By means not shown in the drawing, but well known in the art, the contacts 79^{1-7} may be operated by the sensing elements 10^{1-7} . Thus, for example the contacts 79^{1-7} are operated by pins entering into the holes 14 or the sensing elements 10^{1-7} may be built up as brushes for controlling relays and these relays may operate the contacts 79^{1-7} .

The switching over of contacts 79^{1-7} is effected in combinations, as in FIG. 1, but there is an essential difference between the arrangements of FIGS. 1 and 5 in this respect. There is provision for an automatic delay in both cases, but in FIG. 1 the automatic delay is controlled by the machine itself whereas FIG. 5 shows a special case where the delay is controlled by identity between two successive combinations sensed. In the case of FIG. 5, a combination sensed is stored in the flip-flops 81^{1-7} , and the position or setting of these flip-flops 81^{1-7} is compared with the position of contacts 79^{1-7} after the sensing of the next following combination. The flip-flops 81^{1-7} are built up so that if any one of these flip-flops is switched over corresponding positive pulses are produced in output leads 80^{1-7} . The comparison between two combinations is effected in the following manner. Contacts 79^{1-7} are set by the sensing elements 10^{1-7} and the monostable flip-flop 84 produces a positive pulse which is delivered to the several contacts 79^{1-7} and to the corresponding input leads 82^{1-7} or 83^{1-7} according to the position of the contacts 79^{1-7} . Thereby flip-flops 81^{1-7} are switched over to positions corresponding to the combination just sensed. The positive pulse delivered from the monostable flip-flop 84 is also delivered through lead 85 to the grid of the gas discharge tube 86, igniting it. The delay device 87, which was described in connection with FIG. 1 as a delay device 56, is then started. The pulse from lead 85 is delivered to the stop lead 50, thus stopping the transport of tape 11. The resistance 88 which is in parallel with capacitor 57 is so high that the time constant of capacitor 57 and resistor 54 is not appreciably affected.

If, after the delivery of pulses on leads 82^{1-7} or 83^{1-7} one or more of the flip flops 81^{1-7} switches over, then on the respective leads 80^{1-7} positive pulses are induced which are delivered to the grid of gas discharge tube 90 through lead 89. The tube 90 ignites and effectively short circuits the gas discharge tube 86 and resistance 54, so that capacitor 57 is charged very quickly.

The pulse from lead 89 is delivered through diode 91 to the "start" lead 49 to restart the transport of tape 11. The ignition of tube 90 follows so quickly upon the operation of tube 86 that there is actually no interruption in the tape feed. From the diode 91 this pulse is also delivered on lead 92 to controllable gate 93 making it conductive. Controllable gate 93 is connected in the circuit path from signal heads 65^{1-7} (compare FIG. 4) to lead 94 to counting stage 27. The signal heads 65^{1-7} are connected to the respective inputs of the controlled gates 96^{1-7} by leads 95^{1-7} . The controlled gates 81^{1-7} are controlled by the flip-flops 81^{1-7} in such a way that if the respective contact 79^{1-7} is switched over by a hole 14 in tape 11, then the respective

controllable gate 96^{1-7} is conductive so that pulses from the respective signal head 65^{1-7} may be delivered to the common output lead 97 of the gates 96^{1-7} . These pulses will be delivered through the conductive gate 93 to the controllable gate 98. At the beginning of each rotation of the signal carrier 99, a positive pulse is delivered to the controllable gate 98 on lead 100, to make it conductive. The pulses from lead 97 may pass through the gate 98 to output lead 94 and from there they may be delivered to counting stage 27. The total number of pulses corresponds to the decimal value of the combination sensed from the respective row on tape 11. The selection of one of the magnet coils 39^{1-m} shown in FIG. 1, may be effected by these pulses in a manner as described with reference to FIG. 1.

As shown in FIG. 4, the pulses in the various tracks on signal carrier 99 are so arranged that the signal heads 65^{1-7} operate in succession. Therefore, pulses which pass those of the gates 96^{1-7} which at any time are open, are delivered to the output lead 94 in successive groups, representing a totalization, or decimal value of the combination in the chain 81^{1-7} . At the end of one rotation of the signal carrier 99 a pulse is delivered to the controllable gates 93 and 98, on lead 101, which makes both these gates non-conductive so that only the pulses induced in the signal heads 65^{1-7} during one rotation of the signal carrier 99 may pass to lead 94.

If, during the sensing of the next combination the contacts 79^{1-7} are set in the same positions as during the sensing of the previous combination, then the delivery of pulses from the monostable flip-flop 84 to the respective input leads 82^{1-7} or 83^{1-7} effects no switching over of the flip-flops 81^{1-7} so that no pulse is induced on lead 89. In this case, a pulse is produced only on lead 85, which ignites tube 86 in the described manner so that delay device 87 is made operative. This pulse is applied simultaneously to lead 50 to effect the stoppage of the transport of tape 11.

Capacitor 57 in the delay device 87 charges through resistor 54 and gas discharge tube 55 will eventually be ignited so that a pulse is produced in lead 103. This pulse is delivered to the "start" lead 49 to give a signal for the restarting of tape 11. This pulse from lead 103 is delivered also to lead 92 and therefore allows signal carrier 99 to deliver pulses during the next rotation from signal heads 65^{1-7} to lead 94 according to the then switching position of the flip-flops 81^{1-7} .

It will be apparent that in both conditions a stop pulse appears on the line 50 as a result of sensing a code combination from the tape. However, as pointed out above, it is followed by a start pulse almost immediately if any of the flip-flops 81^{1-7} is switched. The time interval between the pulses is so small that the clutch 3 is unable to respond and remains in engagement. On the other hand, if none of the flip-flops 81^{1-7} is switched, the start pulse is delayed until the capacitor 57 has charged sufficiently through resistor 54 to ignite the tube 55. This delay is sufficient to allow the clutch 3 to be disengaged. The delay may be adjusted by altering the setting of the switch 53.

What I claim is:

1. In an arrangement for controlling control elements of a keyboard and the like machine by signals derived from a record carrier, in combination, first conversion means for sequentially converting record marks prerecorded on the record carrier and respectively representing a variety of data, into signal sequences, the number of signals thereof representing respectively said data; a matrix type arrangement of rows and columns of a plurality of control means selectively operable by application of control signals for controlling the control elements of the keyboard machine respectively associated with said data represented by said marks on said record carrier, each of said control means being responsive only to simultaneous application of a first signal

in column direction and a second signal in row direction; second conversion means connected between said first conversion means and said matrix type arrangement for converting each particular sequence of signals of said first conversion means into said first and second signals and for applying said first and second signals to that column and that row, respectively, which determine at their intersection the particular control means associated with the number of signals contained in the said particular sequence of signals and thereby with the particular data represented by such sequence of signals; and means connected with said first conversion means for intercalating a predetermined period of time between consecutive ones of said signal sequences whenever consecutive marks on said record carrier represent the same data and would therefore entail consecutively repeated actuation of the corresponding control means in said matrix arrangement.

2. Signal operated control means for the control elements of keyboard and the like machines, comprising, in combination, record carrier means carrying a sequence of marks spaced from each other respectively representing a variety of data; sensing means for sensing said marks sequentially and for closing a circuit whenever one of said marks is sensed; moving means for stepwise moving said record carrier means relatively to said sensing means for sequentially positioning said spaced marks, respectively, after each step, in sensing position opposite said sensing means; pulse generator means for sequentially generating, in operational cycles each coinciding with the positioning of a mark in sensing position, groups of pulses, said groups of pulses of each cycle differing by the number of pulses therein, the different numbers of pulses of said groups thereof being respectively associated with the data respectively represented by said different marks; a matrix type arrangement of rows and columns of a plurality of control means selectively operable by application of control pulses, each of said control means being responsive only to simultaneous application of a first pulse in column direction and a second pulse in row direction, for controlling the control elements of the keyboard machine respectively associated with said data represented by said marks on said record carrier means; circuit means connecting said pulse generator means via said sensing means with said control means in said matrix arrangement, and including counter means for counting the number of pulses transmitted from said pulse generator means during each operational cycle via said sensing means depending upon the particular marks sensed during such cycle, and for applying said first and second pulses to a particular one of said control means associated with the particular data represented by the marks sensed during said cycle and by the number of said pulses transmitted and counted; and delay means connected between said sensing means and said moving means for intercalating a predetermined period of time between consecutive steps of movement of said record carrier means whenever consecutive marks on said record carrier means represent the same data and would therefore entail consecutively repeated actuation of the corresponding control means in said matrix arrangement.

3. In a signal operated control device for controlling the control elements of a keyboard or the like machine, in combination, pulse generator means for sequentially generating, in operational cycles, groups of pulses, said groups of pulses of each cycle differing by the number of pulses therein, the different numbers of pulses of said groups thereof being respectively representative of data to be reproduced by actuation of said control elements; a matrix type arrangement of rows and columns of a plurality of control means, selectively operable by application of control pulses, for controlling the control elements of the keyboard machine respectively associated with said data, each of said control means being

responsive only to simultaneous application of a first pulse in column direction and a second pulse in row direction; conversion means connected between said pulse generating means and said matrix type arrangement for converting each particular sequence of said groups of pulses of said pulse generator means into said first and second pulses and for applying said first and second pulses to that column and to that row, respectively, which determine at their intersection the particular control means associated with the number of pulses contained in the particular sequence of pulses and therefore with the particular data represented by such sequence of pulses; and delay means connected with said pulse generator means for intercalating a predetermined period of time between consecutive ones of said groups of pulses whenever consecutive representations represent the same data and would therefore entail consecutively repeated actuation of the corresponding control means in said matrix arrangement.

4. A device as claimed in claim 3, wherein each of said control means comprises solenoid means having a first and a second winding, said first winding being connected with said conversion means for receiving said first pulses, said second winding being connected to said conversion means for receiving said second pulses, said first and second windings being so dimensioned that only upon simultaneous application of said first and second pulses to a particular one of said solenoid means the latter is rendered operative.

5. In a signal operated control device for controlling the control elements of a keyboard or the like machine, in combination, record carrier means carrying a sequence of marks spaced from each other respectively representing a variety of data; sensing means for sensing said marks sequentially and for closing a circuit whenever one of said marks is sensed; moving means for stepwise moving said record carrier means relatively to said sensing means for sequentially positioning said spaced marks, respectively, after each step, in sensing position opposite said sensing means coupled to said moving means; feed control means for stopping and starting the stepwise movement of said record carrier means; delay means connected with said sensing means and with said feed control means for causing the latter to stop said movement and restart the same after a predetermined period of time between sensing of consecutive marks of said record carrier means whenever consecutive marks on said record carrier means represent the same data.

6. A device as claimed in claim 5, wherein said delay means comprises means adapted to distinguish between data sensed by said sensing means from consecutive marks on said record carrier means and for storing the data sensed from the second one of said consecutive marks whenever data represented by the first and second ones of said consecutive marks is identical, said delay means further comprising means for controlling said feed control means to control the stepwise movement of said record carrier means in one manner upon non-identity between said data represented by consecutive marks and for controlling the stepwise movement of said record carrier means in another manner upon identity between said last-mentioned data.

7. In a signal operated control device for controlling the control elements of a keyboard, line composing and the like machine, in combination, record carrier means for producing a plurality of signals in accordance with a predetermined code recorded in said record carrier means, said code representing data to be reproduced by said control elements; a matrix type arrangement comprising a plurality of solenoid elements each including a winding having at least two terminals, a first group of conductors, each of said first group of conductors being connected to one terminal of the terminals of each of said plurality of solenoid elements, a second group of conductors, each of said second group of conduc-

tors being connected to another terminal of the terminals of each of said solenoid elements; a first group of driving means, each driving means of said first group of driving means being connected to an end of each conductor of said first group of conductors; a second group of driving means, each driving means of said second group of driving means being connected to an end of each conductor of said second group of conductors, said first and second groups of driving means being adapted to energize selected ones of said solenoid elements through the conductors of said first and second groups of conductors, each of said solenoid elements which is energized having its terminals respectively energized by a conductor of each of said first and second groups of conductors; transfer means for transferring the signals produced by said record carrier means to each of said first and second groups of driving means thereby to set the said first and second groups of driving means under the influence of the coded data recorded in said record carrier means so that said control elements are energized in accordance with the code combination recorded on said record carrier means; moving means for stepwisely moving said record carrier means; and delay means coupled to said moving means for intercalating a predetermined period of time between consecutive steps of movement of said record carrier means.

8. In a signal operated control device for controlling the control elements of a keyboard, line composing and the like machine, in combination, record carrier means for producing a plurality of signals in accordance with a predetermined code recorded in said record carrier means, said code representing data to be reproduced by said control elements; sensing means for sequentially sensing coded data items in said record carrier means; moving means for stepwisely moving said record carrier means relatively to said sensing means for sequentially positioning said recorded coded data items; a matrix type arrangement comprising a plurality of solenoid elements each including a winding having at least two terminals, a first group of conductors, each of said first group of conductors being connected to one terminal of the terminals of each of said plurality of solenoid elements, a second group of conductors, each of said second group of conductors being connected to another terminal of the terminals of each of said solenoid elements; a first group of driving means, each driving means of said first group of driving means being connected to an end of each conductor of said first group of conductors; a second group of driving means, each driving means of said second group of driving means being connected to an end of each conductor of said second group of conductors, said first and second groups of driving means being adapted to energize selected ones of said solenoid elements through the conductors of said first and second groups of conductors, each of said solenoid elements which is energized having its terminals respectively energized by a conductor of each of said first and second groups of conductors; transfer means for transferring the signals produced by said record carrier means to each of said first and second groups of driving means thereby to set the said first and second groups of driving means under the influence of the coded data recorded in said record carrier means so that said control elements are energized in accordance with the code combination recorded on said record carrier means; and delay means coupled to said moving means for intercalating a predetermined period of time between consecutive steps of movement of said record carrier means.

9. In a signal operated control device for controlling the control elements of a keyboard, line composing and the like machine, in combination, record carrier means for producing a plurality of signals in accordance with a predetermined code recorded in said record carrier means, said code representing data to be reproduced by said control elements; sensing means for sequentially sensing coded data items in said record carrier means;

moving means for stepwisely moving said record carrier means relatively to said sensing means for sequentially positioning said recorded coded data items; moving control means coupled to said moving means for controlling the operation of said moving means; a matrix type arrangement comprising a plurality of solenoid elements each including a winding having at least two terminals, a first group of conductors, each of said first group of conductors being connected to one terminal of the terminals of each of said plurality of solenoid elements, a second group of conductors, each of said second group of conductors being connected to another terminal of the terminals of each of said solenoid elements; a first group of driving means, each driving means of said first group of driving means being connected to an end of each conductor of said first group of conductors; a second group of driving means, each driving means of said second group of driving means being connected to an end of each conductor of said second group of conductors, said first and second groups of driving means being adapted to energize selected ones of said solenoid elements through the conductors of said first and second groups of conductors, each of said solenoid elements which is energized having its terminals respectively energized by a conductor of each of said first and second groups of conductors; transfer means for transferring the signals produced by said record carrier means to each of said first and second groups of driving means thereby to set the said first and second groups of driving means under the influence of the coded data recorded in said record carrier means so that said control elements are energized in accordance with the code combination recorded on said record carrier means; delay means coupled to said moving control means for intercalating a selected period of time between consecutive steps of said record carrier means; and delay control means coupled between said sensing means and said delay means for intercalating a selected period of time between consecutive steps of said record carrier means.

10. In a signal operated control device for controlling the control elements of a keyboard, line composing and the like machine, in combination, record carrier means for producing a plurality of signals in accordance with a predetermined code recorded in said record carrier means, said code representing data to be reproduced by said control elements; sensing means for sequentially sensing coded data items in said record carrier means; moving means for stepwisely moving said record carrier means relatively to said sensing means for sequentially positioning said recorded coded data items; moving control means coupled to said moving means for controlling the operation of said moving means; a matrix type arrangement comprising a plurality of solenoid elements each including a winding having at least two terminals, a first group of conductors, each of said first group of conductors being connected to one terminal of the terminals of each of said plurality of solenoid elements, a second group of conductors, each of said second group of conductors being connected to another terminal of the terminals of each of said solenoid elements; a first group of driving means, each driving means of said first group of driving means being connected to an end of each conductor of said first group of conductors; a second group of driving means, each driving means of said second group of driving means being connected to an end of each conductor of said second group of conductors, said first and second groups of driving means being adapted to energize selected ones of said solenoid elements through the conductors of said first and second groups of conductors, each of said solenoid elements which is energized having its terminals respectively energized by a conductor of each of said first and second groups of conductors; transfer means for transferring the signals produced by said record carrier means to each of said first and second groups of driving means thereby to set the said first and second groups of driving means under the influence of the coded

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data recorded in said record carrier means so that said control elements are energized in accordance with the code combination recorded on said record carrier means; delay means coupled to said moving control means for intercalating a selected period of time between consecutive steps of said record carrier means; and delay control means coupled between said sensing means and said delay means for intercalating a selected period of time between consecutive steps of said record carrier means, said delay control means comprising means for terminating the period of delay time of said delay means upon the sensing of non-identical consecutive coded data items by said sensing means and for extending the period of delay time of said delay means upon the sensing of identical consecutive coded data items by said sensing means.

11. In a signal operated control device for controlling the control elements of a keyboard, line composing and the like machine, in combination, record carrier means for producing a plurality of signals in accordance with a predetermined code recorded in said record carrier means, said code representing data to be reproduced by said control elements, said code comprising coded data units each comprising at least one mark in different code positions; sensing means for sequentially sensing coded data items in said record carrier means; moving means for stepwisely moving said record carrier means relatively to said sensing means for sequentially positioning said recorded coded data items; moving control means coupled to said moving means for controlling the operation of said moving means, a matrix type arrangement comprising a plurality of solenoid elements each including a winding having at least two terminals, a first group of conductors, each of said first group of conductors being connected to one terminal of the terminals of each of said plurality of solenoid elements, a second group of conductors, each of said second group of conductors being connected to another terminal of the terminals of each of said solenoid elements; a first group of driving means, each driving means of said first group of driving means being connected to an end of each conductor of said first group of conductors; a second group of driving means, each driving means of said second group of driving means being connected to an end of each conductor of said second group of conductors, said first and second groups of driving means being adapted to energize selected ones of said solenoid elements through the conductors of said first and second groups of conductors, each of said solenoid elements which is energized having its terminals respectively energized by a conductor of each of said first and second groups of conductors; transfer means for transferring the signals produced by said record carrier means to each of said first and second groups of driving means thereby to set the said first and second groups of driving means under the influence of the coded data recorded in said record carrier means so that said control elements are energized in accordance with the code combination recorded on said record carrier means; delay means coupled to said moving control means for intercalating a selected period of time between consecutive steps of said record carrier means; a plurality of bistable circuit means each having at least one output and each corresponding to a different code position of each coded data unit of said predetermined code; coupling means coupling said sensing means to said bistable circuit means in a manner whereby selected ones of said bistable circuit mean corresponding to the code positions of the coded data item sensed by said sensing means are switched in stable state in correspondence with the coded data item sensed by said sensing means thereby producing an output pulse in said output, said coupling means including pulse supply means coupled to said bistable circuit means and said delay means for supplying a pulse to said selected ones of said bistable circuit means and for supplying the pulse provided by said pulse supply means

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to said delay means for initiating the period of delay time; and control means coupling the outputs of said bistable circuit means to said delay means for intercalating a selected period of time between consecutive steps of said record carrier means, said control means supplying the output pulse produced by said bistable circuit means to said delay means for terminating the period of delay time.

12. In a signal operated control device for controlling the control elements of a keyboard, line composing and the like machine, in combination, record carrier means for producing a plurality of signals in accordance with a predetermined code recorded in said record carrier means, said code representing data to be reproduced by said control elements, said code comprising coded data units each comprising at least one mark in different code positions; sensing means for sequentially sensing coded data items in said record carrier means; moving means for stepwisely moving said record carrier means relatively to said sensing means for sequentially positioning said recorded coded data items; moving control means coupled to said moving means for controlling the operation of said moving means; a matrix type arrangement comprising a plurality of solenoid elements each including a winding having at least two terminals, a first group of conductors, each of said first group of conductors being connected to one terminal of the terminals of each of said plurality of solenoid elements, a second group of conductors, each of said second group of conductors being connected to another terminal of the terminals of each of said solenoid elements; a first group of driving means, each driving means of said first group of driving means being connected to an end of each conductor of said first group of conductors; a second group of driving means, each driving means of said second group of driving means being connected to an end of each conductor of said second group of conductors, said first and second group of driving means being adapted to energize selected ones of said solenoid elements through the conductors of said first and second groups of conductors, each of said solenoid elements which is energized having its terminals respectively energized by a conductor of each of said first and second groups of conductors; transfer means for transferring the signals produced by said record carrier means to each of said first and second groups of driving means thereby to set the said first and second groups of driving means under the influence of the coded data recorded in said record carrier means so that said control elements are energized in accordance with the code combination recorded on said record carrier means; delay means coupled to said moving control means for intercalating a selected period of time between consecutive steps of said record carrier means; a plurality of bistable circuit means each having two outputs and being adapted to produce an output pulse at a first of said outputs each time a coded data item is sensed and being adapted to produce an output pulse at a second of said outputs each time the stable state of the said bistable circuit means is switched and each corresponding to a different code position of each coded data unit of said predetermined code; coupling means coupling said sensing means to said bistable circuit means in a manner whereby selected ones of said bistable circuit means corresponding to the code positions of the coded data item sensed by said sensing means are switched in stable state in correspondence with the coded data item sensed by said sensing means thereby producing an output pulse in said first output thereof, said coupling means including pulse supply means coupled to said bistable circuit means and said delay means for supplying a pulse to said selected ones of said bistable circuit means and for supplying said pulse provided by said pulse supply means to said delay means for initiating the period of delay time; control means cou-

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pling said second outputs of said bistable circuit means to said delay means for intercalating a selected period of time between consecutive steps of said record carrier means, said control means supplying the output pulse produced by said bistable circuit means in said second outputs thereof to said delay means for terminating the period of delay time; a plurality of gate means each having a first input connected to the first output of a corresponding one of said bistable circuit means, a second input and an output coupled to said driving means, each of said gate means being adapted to conduct a signal supplied to said second input upon simultaneous receipt of signals at both the first and second inputs thereof; pulse generating means for producing a plurality of groups of pulses, each group of pulses comprising a number of pulses corresponding to a different code position of each coded data unit; means for supplying a different group of said groups of pulses to the second input of each corresponding one of said gate means, each of said plurality of gate means, bistable circuit means, sensing means and groups of pulses being of equal number and in correspondence with each other and with the code mark positions of each coded data unit so that selected ones of said gate means corresponding to said selected ones of said bistable circuit means are conductive and

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transmit a number of pulses corresponding to said coded data item sensed by said sensing means from said pulse generating means via the output means of said selected gate means to said driving means.

References Cited by the Examiner

UNITED STATES PATENTS

| | | | |
|-----------|---------|-----------------|-----------|
| 2,767,243 | 10/1956 | Steenek | 178—17.5 |
| 2,792,987 | 5/1957 | Stibity | 340—174 |
| 2,802,203 | 8/1957 | Stuart-Williams | 340—166 |
| 2,819,940 | 1/1958 | Sorrells | 340—174 |
| 2,911,622 | 11/1959 | Ayers | 340—174 |
| 2,911,624 | 11/1959 | Booth | 340—174 |
| 2,913,705 | 11/1959 | Cox | 340—174 |
| 2,918,655 | 12/1959 | Palvari | 340—173 |
| 2,931,014 | 3/1960 | Buchholz et al. | 340—172.5 |

OTHER REFERENCES

Proceedings of the Eastern Joint Computer Conference, pages 22—23, Dec. 8—10, 1954.

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